Functional Demonstration of Accelerometer-Assisted Beacon Tracking

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ABSTRACT

NASA/JPL has been developing technologies to accurately point a communication laser beam from deep space with sub-micro-radian precision for data transmission systems. The approach is based on using high bandwidth inertial sensors to compensate for jitter excursions caused by spacecraft vibrations. This use of high bandwidth inertial sensors enables the implementation of laser communication links anywhere within the solar system and beyond.

A functional demonstration of closed-loop accelerometer-assisted beacon tracking under simulated spacecraft vibration was undertaken, in order to validate innovative concepts, technologies, sub-systems and algorithms that achieve the sub-micro-radian pointing accuracy necessary for optical communication systems from deep space. The laboratory demonstration included integration of the complete acquisition, tracking, and pointing (ATP) sub-system integrated with inertial sensors - accelerometers. Double integration, bias and initial velocity estimation algorithms were developed, verified and implemented. Accelerometer performance was characterized and integrated to sub-system. The beacon was mounted on a vibration platform that simulates s/c vibrations. Vibrations were introduced into beacon and were simultaneously sampled by accelerometer. The signals were used to close the pointing loop. Closed loop tracking of the vibrating beacon was achieved using the accelerometer information. This presentation will describe the details of the functional demonstration of accelerometer-assisted beacon tracking in a laboratory environment under simulated s/c vibration.

Keywords: Acquisition, tracking and pointing, accelerometer, free-space communications, deep space communications, optical communications.

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